THE "MONEY" SIDE OF BUNTED WHEAT

BY

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Bunt, or stinking smut, is very familiar to farmers, who often loosely call it "smut." True smut (or loose smut) results in the ears on infected plants being covered all over with a sooty "powder." This powder, actually, is made up of innumerable little black "spores," which are the reproductive bodies of the smut fungus. Everyone of these minute spores can infect a plant in next year's crop. In bunt (or stinking smut), on the other hand, the tiny spores occur inside the "bunt balls" which take the places of the grains on bunted ears of wheat. The smallness of the spores and the spreading capacity of the disease may be gauged from the fact that a single bunt ball may contain as many as nine million spores. In the past few years renewed scientific attention has been given to the bunt question, both here and in other countries. One result has been to show that there is more to fear from bunt than was previously supposed. Until quite recently, however, the "money" side of the matter had not been closely examined, and it is upon this that the passages which follow mainly bear.

THE FARMER'S ATTITUDE.

The various seed-wheat dressings for bunt—blue stone, formalin, or the more recently introduced powder treatments —are well known. Many farmers invariably dress their seed wheat, but not a few are inclined to argue that dressing is troublesome; that wet-dressed seed germinates indifferently if bad weather causes delay in drilling; and finally that "a bit of bunt doesn't matter much."

If pressed, the farmer who does not bother to dress his

seed, would probably retaliate with a set of questions—and thoroughly pertinent questions they are:—

"How much bunt is there in the country? To what extent does it reduce the yield? Does it often affect the market price, and how much bunt can you have in selling a parcel of wheat without being found out? Is dressing always a preventive, and how badly bunted a sample dare you sow without dressing?"

The inquiries to be described answer a number of these questions; but it is necessary, as a preliminary, to explain the life and activities of the bunt fungus.

HOW BUNT AFFECTS THE CROP.

Bunt balls may readily be found in the ears of bunted plants in a field or in the threshed grain. Every ball contains several millions of tiny spores. The threshing drum smashes most of the balls and thus dusts the spores all over the healthy grains. Wheat from a badly bunted field has a "dirty" colour and a "fishy" smell because of the spores adhering to the grains. It may be noted, too, that the drum itself may become dirty with spores, and so take the disease on to the next farm.

Consider a wheat grain, with a number of the tiny bunt spores attached, which is sown in the soil. It germinates and sends up a shoot. At the same time some of the bunt spores germinate and send a very fine fungus "thread" into the seedling wheat plant. As the plant grows, so these threads invade it. When the wheat comes into ear the fungus is firmly established in each small flower of the ear and turns what should have been a wheat grain into a bunt ball or small bagful of spores. This cycle of events is then, of course, repeated in the next crop. The various seed-dressings have the effect of killing any spores which may be sticking on the wheat grains.

THE AMOUNT OF BUNT IN THE COUNTRY.

The Official Seed-Testing Station (part of the National Institute of Agricultural Botany, Cambridge) makes an examination of the seed-borne disease in the many samples sent to it for tests of germination capacity. In addition, the station has conducted a number of special inquiries upon seed-borne diseases. Through the kindness of the Chief

Officer of the station it is possible to give certain facts which indicate the prevalence of bunt in the country's wheat crop. Ordinarily, samples are noted as "bunted" only if they contain actual bunt balls, the more searching examination by microscope being reserved for special inquiries. Over a seven-year period the results were:—

Year.	*Percentage of wheat samples in which bunt balls were found.*
1918	6 per cent.
1919	6 ,, ,,
1920	8 ,, ,,
1921	33 ,, ,,
1922	16 ,, ,,
1923	16 ,, ,,
1924	14 ,, ,,

The proportions are—for a preventable disease—very high, and do not appear to be diminishing. To a branch of arable farming in which prospects are not bright they represent a definite menace. But these figures tell by no means the whole story. A sample may be definitely bunted and yet contain no whole bunt balls; the grains may have many spores on them, and, as will be shown, even a light coat of spores can spread disease in the following crop. In one year 400 ordinary samples received for germination test were examined both for presence of bunt balls and also, by the microscope, for bunt spores attached to the grains. While only 18 per cent. of the samples contained bunt balls, 64 per cent. were definitely contaminated with spores.

THE MILLER'S EYE AND NOSE.

For bunt in wheat, as for onion or dampness, the miller has a keen perception. It was decided to test him. Six samples were drawn from a sack of wheat and put into sample bags. One sample was left untouched, a second was "bunted" at the rate of 20 bunt balls to 1 lb. of wheat, a third at the rate of 30 bunt balls to 1 lb. of wheat, and so on. The bags were violently shaken, so that, as in the thresher, the bunt balls were smashed, and their spores scattered over the grains. The six samples were submitted to two millers, known to be good judges of English wheat. They were told nothing, but simply asked to quote market

values. One was slightly in error, but the other priced the samples exactly in the order of the amount of bunt. His quotations were:—

Number of bunt balls per 1 lb. of wheat in the sample.	*Miller's quotation (per quarter) for 1927 crop.*
0	... 54/-
20	... 53/9
30	... 53/6
40	... 53/3
50	... 52/9
60	... 52/6

This miller, asked afterwards for his reasons, said that all the samples were good wheat but for the fact that some were bunted, and he had quoted according to the amount of bunt.

Some students and three farmers were invited to test the samples. It was concluded that even the average buyer familiar with wheat would detect bunt present to an extent corresponding to thirty bunt balls in 1 lb. of wheat (the reduction in price being 6d. per quarter). Let us see what this means. From evidence too full to give here it may be shown that in a crop bunted to this extent there will be one bunted plant in every 900 plants, i.e., roughly one-tenth of one per cent. of the plants in the field will be affected. Now take the case where the reduction in price was 1/6, i.e., from 54/- down to 52/6. The amount of bunt was 60 bunt balls in 1 lb. of grain. This corresponds to the bunted plant in every 450 in the field, i.e., a percentage infection of about one-fifth of one per cent. In practice infections of this order may, unfortunately, be seen not infrequently. It follows that there are still farmers who suffer when they take their corn to market simply because it is bunted.

THE PRACTICAL MEANING OF BUNTED SEED.

To find out how the amount of bunt in the seed sown affects the amount in the resulting crop, two sets of experiments were made. In the first the seed was very heavily infected with bunt, and an account of these experiments is deferred to a later passage, where tests of bunt prevention are described. Comparatively slight infections were used in the second set of experiments. The work was twice repeated, and the results, set out below,

are averages for the two trials. For simplicity the degree of infection of the seed is shown in the form of number of bunt balls to every 1 lb. of seed.

Infection of Seed.	*Percentage of bunted plants in resulting crop.*
26 bunt balls to 1 lb. of seed ...	4.3 per cent.
8 ,, ,, ,, ,, ,, ,, ...	1.4 ,, ,,
5 ,, ,, ,, ,, ,, ,, ...	0.7 ,, ,,
2 ,, ,, ,, ,, ,, ,, ...	0.4 ,, ,,

We see, then, that even the slight seed infection of two bunt balls to 1 lb. of grain leads to an infection of the resulting crop to the extent of 0.4 per cent. of the plants. But the price figures already given must be recalled. A loss of 1/6 per quarter occurred when the crop had 60 bunt balls to every pound of grain, which is equivalent to one bunted plant in every 450, i.e., an infection percentage of only about 0.22 per cent. Such an infection would probably result—so we may infer from the figures above—if the seed had as little as one bunt ball to every 1 lb. of seed. Such a seed sample would have come from a crop in which only one in every 8,500 plants was bunted. This corresponds to only about 100 bunted plants per acre of crop. The casual observer would hardly notice so light an attack: but to use such a crop for seed would be to incur, in the following year, a loss of 1/6 per quarter in the sale price of the grain because of bunt. To recapitulate:

1*st year.*—A crop of wheat shows a slight bunt attack; actually only *one* plant in every 8,500 is bunted.

Seed from this crop is sown; it contains one bunt ball to every 1 lb. of seed.

2*nd year.*—The resulting crop has one plant bunted in every 450 plants.

The grain is sold; it has 60 bunt balls to every pound of grain; the purchaser in consequence cuts the price by 1/6 per quarter.

If the grain of the second year had been sown instead of sold the third year's crop would, of course, have been very heavily infected indeed (25—30 per cent. of the plants would

have been bunted, and the grain would have been unsaleable and unuseable). This unhappy course of events supposes that the seed was not dressed against bunt. In conclusion, therefore, let us see the effect of dressing.

THE EFFECTIVENESS OF DRESSING.

In the set of experiments upon this subject the grain was very heavily bunted (by adding bunt balls and thoroughly shaking). Various dressings were applied to the seed so treated, which was then sown under normal conditions. The results were:—

Infection of Seed.	*Seed Dressing.*	*Percentage of bunted plants in resulting crop.*
1,000 bunt balls to 1 lb. of seed	None	90
1,000 ,, ,, ,, ,, ,, ,,	Copper carbonate (3 oz. per bushel)	10
1,000 ,, ,, ,, ,, ,, ,,	Formalin (1 part in 240 of water)	0
1,000 ,, ,, ,, ,, ,, ,,	Copper sulphate 2½%	3
500 ,, ,, ,, ,, ,, ,,	None	78
500 ,, ,, ,, ,, ,, ,,	Copper carbonate (3 oz. per bushel)	5
250 ,, ,, ,, ,, ,, ,,	None	50
250 ,, ,, ,, ,, ,, ,,	Copper carbonate (3 oz. per bushel)	3
50 ,, ,, ,, ,, ,, ,,	None	25
50 ,, ,, ,, ,, ,, ,,	Copper carbonate (3 oz. per bushel)	1

These rates of infection represent seed completely blackened by bunt, and which not even the most careless would run the risk of sowing. And yet—the figures above are too emphatic to need explanation—the various treatments are extraordinarily effective. Dressing for bunt is, indeed, cheap, easy, effective—indispensable.

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